

Amendments to the Claims:

This listing of claims will replace all prior versions and listing of claims in the application.

Listing of Claims:

1. - 11. (Canceled)

12. (Currently Amended) A backup and recovery method for a storage system that avoids journal overflow, the method comprising:

producing at least a first snapshot of a data volume, said data volume being ~~which is~~ configured to receive data by way of write operations issued from a host device;

producing a journal entry for each write operation issued from the host device;
storing each journal entry in a journal volume, thereby accumulating a list of journal entries;

monitoring an amount of free space on the journal volume upon receiving a write operation; and

~~when the free space falls below a threshold value, stopping the storing of journal entries~~ when the free space falls below a threshold value, thereby avoiding journal overflow; and

~~switching to bitmap management and taking a logical snapshot of the data volume~~ by using a bitmap representation of storage areas in the data volume to track

the storage areas in the data volume to which write operations are directed until additional capacity is provided for the journal volume, thereby avoiding journal overflow.

13. (Currently Amended) A backup and recovery method according to claim 12, wherein when the storing of journal entries ~~have~~has been stopped to prevent journal overflow and control is switched to bitmap management, said method further comprising:

adding capacity to said journal volume by adding more storage media for use in storing journal entries.

14. (Currently Amended) A backup and recovery method according to claim ~~12~~ 13, further comprising ~~wherein said logical snapshot includes changes to the data stored on the data volume as represented by a bitmap,~~

~~wherein each bit of the bitmap indicates whether a change has been made to a corresponding area of the data volume~~

storing a new journal entry in the storage volume following adding of capacity by taking a logical snapshot that includes deleting any stored journal entries corresponding in the bitmap to the new journal entry.

15. (Original) A backup and recovery method according to claim 12, wherein said threshold value is set in a management table which includes a plurality of entries each containing information of respective journal volumes.

16. (Original) A backup and recovery method according to claim 15, wherein one of said entries of said management table includes an indication of the size of a journal pool which includes said journal volume.

17. (Currently Amended) A backup and recovery method according to claim 16, wherein said threshold value is an indication of the lowest amount of free ~~capacity~~ space of the journal pool the storage system is allowed to reach.

18. (Currently Amended) A backup and recovery method according to claim 17, wherein said threshold value is an indication of the lowest percentage measure of the amount of free ~~capacity~~ space to the total amount of capacity of the journal pool the storage system is allowed to reach.

19. - 23. (Canceled)

24. (New) A backup and recovery method for a storage system that avoids journal overflow, the method comprising:

providing a journal pool for storage of journal entries, said journal pool having a storage capacity;

producing a first snapshot of a data volume, said data volume being configured to receive data by way of write operations issued from a host device, said snapshot being a copy of data of said data volume at a point in time;

monitoring an amount of free space in the journal pool upon receiving a write operation;

storing a journal entry in the journal pool for each write operation directed to said data volume if the free space in the journal pool is not less than a threshold value;

stopping the storing of journal entries in the journal pool when the free space in the journal pool falls below the threshold value, thereby avoiding overflow of the journal pool;

switching to bitmap management upon stopping storage of journal entries, wherein changes to the data stored on the data volume are represented by a bitmap, and a condition of each bit of the bitmap indicates whether a change has been made to a corresponding storage area of the data volume.

25. (New) A backup and recovery method according to claim 24, further including adding capacity to said journal pool following stopping of storage of journal entries by allocating additional storage media to said journal pool.

26. (New) A backup and recovery method according to claim 25, further including storing a new journal entry in the storage pool following adding of capacity by taking a logical snapshot that includes deleting any stored journal entries corresponding in the bitmap to the new journal entry.

27. (New) A backup and recovery method according to claim 24, wherein said threshold value is set in a management table that includes a plurality of entries, each containing information of journal volumes in said journal pool.

28. (New) A backup and recovery method according to claim 27, wherein one of said entries of said management table includes an indication of the capacity of the journal pool.

29. (New) A backup and recovery method according to claim 28, wherein said threshold value is an indication of the lowest amount of free space the capacity of the journal pool is allowed to reach.

30. (New) A backup and recovery method according to claim 29, wherein said threshold value is an indication of the lowest percentage measure of the amount of free space to the total amount of capacity of the journal pool that is allowable.

31. (New) A backup and recovery method for a storage system that avoids journal overflow in said storage system, the method comprising:

- providing a journal pool for storage of journal entries, said journal pool having a storage capacity;

- defining a threshold of available capacity for the journal pool;

- taking a first snapshot by a controller in the storage system, said snapshot being a copy of a data volume, said data volume being configured to receive data by way of write requests issued from a host computer;

- checking available capacity of the journal pool by the controller when a write request is received;

- storing a journal entry in the journal pool if the available capacity of the journal pool is not below the threshold;

- stopping the storing of journal entries by the controller if the available capacity of the journal pool is less than the threshold to avoid journal pool overflow;

- switching to bitmap management by the controller upon stopping the storing of journal entries, wherein the bitmap management tracks changes to the data in the data volume using a bitmap that represents storage areas in the data volume to keep track of the storage areas in the data volume to which new write operations are directed until additional capacity is provided for the journal pool;

- adding capacity to the journal pool by adding disks to the storage system;

- taking a logical snapshot and making a new journal entry for the logical snapshot;

returning operation of the controller to storing subsequent journal entries in the journal pool so long as the available capacity of the journal pool is not less than the threshold.

32. (New) A backup and recovery method according to claim 31, wherein taking a logical snapshot includes deleting any stored journal entries corresponding in the bitmap to the new journal entry.

33. (New) A backup and recovery method according to claim 31, wherein said threshold value is set in a management table that includes a plurality of entries, each containing information of journal volumes in said journal pool.

34. (New) A backup and recovery method according to claim 33, wherein one of said entries of said management table includes an indication of the capacity of said journal pool.

35. (New) A backup and recovery method according to claim 34, wherein said threshold value is an indication of the lowest amount of available capacity of the journal pool the storage system is allowed to reach.

36. (New) A backup and recovery method according to claim 35, wherein said threshold value is an indication of the lowest percentage measure of the amount of available capacity to the total amount of capacity of the journal pool allowable.